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An Educational Assessment of Mahadaga, Burkina Faso

Katie Patton

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May 5, 2009

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An Educational Assessment of Mahadaga, Burkina Faso

Background

Over the past thirteen years, the Collaboratory for Strategic Partnerships and Applied Research of Messiah College has developed a relationship with the West African village of Mahadaga, Burkina Faso. This connection was made specifically with the Center for the Advancement of the Handicapped (CAH), a school and therapy center for people with disabilities, run by the organization Serving In Mission. Dr. Angela Hare, Associate Professor of Mathematics and Mathematics Education at Messiah College, first traveled with the Collaboratory to Mahadaga in January 2006. She spoke with teachers at the CAH, and they expressed to her the difficulties their students have in the subject of mathematics. Since that trip, a new group, the Education Group, developed within the Collaboratory and began focusing on improving mathematics education in Mahadaga and the broader West African region. The first project that the Education Group worked on was the Strengthening Math Literacy project. This was a three-year initiative to help children in Mahadaga learn basic math and number skills that would provide them with a strong foundation for the other mathematical concepts they will learn throughout their education. The first phase of the Strengthening Math Literacy project was to create a counting book that would teach basic counting concepts and number recognition. This book was illustrated specifically to appeal to West African children, and it was modified with Braille numbers and embossing so that the book could be used by children with vision impairments. Although it was clear that the children in Mahadaga appreciated the book, the Education Group realized that the French text in the book was too advanced for

children who were at the stage of learning how to count. In order to help support mathematics literacy in Mahadaga, the Education Group needed to know more information about the culture there. This project grew out of the Strengthening Math Literacy project to provide a way of gathering relevant information and presenting it in a useful manner. More information about the Education Group and their projects can be found at http://www.thecollaboratoryonline.org/wiki/Education_Group.

Purpose

This project that developed, An Educational Assessment of Mahadaga, Burkina Faso, is to design and conduct a survey about education in the village of Mahadaga and to summarize the results. This assessment was intended to provide future Education Group members with baseline data of household demographics and education in Mahadaga.

The specific objectives for this survey were:

1. To understand the environment in which Burkinabè children learn
2. To recognize the levels of education of several generations of persons in Mahadaga
3. To learn the dominant trades and occupations of men and women in the village
4. To become familiar with the education level of primary school teachers

Research & Design (Fall 2008)

Design of Survey

In order to reach the project objectives, the fall semester was spent researching ways to gather, analyze and present data, and developing the survey. A literature review was conducted to determine possible procedures for collecting information about the

people in Mahadaga, the population of interest. During this time, statistical methods were also reviewed since they would be used to present the quantitative and qualitative findings in this study. In order to design a culturally appropriate study, native French speakers and authorities on West African culture were asked to review the survey draft.

After reviewing the relevant literature, it was clear that oral surveys for families and children and written surveys for teachers in Mahadaga were the most effective ways of collecting data. Oral surveys were used for the majority of the subjects since it was likely that some of them would not be literate. Since teachers in Burkina Faso must go through some training process, it was assumed that all of the teachers would be capable of responding to a written survey. The next step in the design process was to brainstorm questions for each sample group. Using the project objectives as a starting point, questions that would illuminate pertinent information about the three groups within the population were developed. Additional resources for constructing this survey were studies with similar goals that had been conducted in other African countries. Some of the questions that they had used in their surveys of family demographics were included in the Mahadaga survey so that possible connections between these variables and levels of education in Mahadaga could be investigated. Boxplots, stem and leaf displays, bar graphs and Chernoff Faces would be used to present the data once it was collected. These methods would show the relationships between different variables being observed, and they would be able to compare groups or individuals within the sample.

After a first draft of the survey was created, Dr. Hare and her French tutor translated the questions so that a Burkinabè translator would be able to read the questions and then ask them in the native language of the family being interviewed. Dr. Ray

Norman, Dean of the school of Mathematics, Engineering and Business at Messiah College, also reviewed the survey to confirm the accuracy of the French and to provide any recommendations for making the survey as culturally appropriate as possible.

Dr. Norman, who was a missionary in West Africa for many years, provided valuable insight for improving the survey. After reading through the survey he made several recommendations for improving its structure. One of his main suggestions was that a chart be used to organize the names and ages of people living in a household. He explained that this would save time for the person recording the information, and that it would be clearer for the people who look at the raw data in the future. Dr. Norman also cautioned against giving example answers for any of the questions, because that could lead the interviewee to respond to the question with one of the suggested answers rather than sharing his or her personal thoughts. Another recommendation that Dr. Norman shared was in regard to the Child Survey. One of the initial ideas for that survey was to allow children to use stickers placed on a page to indicate their answers to certain questions. Dr. Norman recognized that giving children who are unaccustomed to stickers or manipulatives would lead to over stimulation, and distract the children from giving honest answers.

Dr. Anita Voelker, an Associate Professor of Education, also provided input for the techniques that would be used to interview children. Based on her own experience, she stated that visual aids and manipulatives can be useful for surveying children because these tools can draw their interest and help them to feel comfortable answering questions. Based on both Dr. Voelker and Dr. Norman's suggestions, it was decided that simple picture cards, held by the interviewer, would accompany certain questions on the child

survey. These illustrations would provide visual cues to help the children think about the question, without overwhelming them with new experiences.

Survey Description

Informed Consent

As part of the survey process, a statement of informed consent was developed as part of the survey procedure required by the Internal Review Board. One statement was written for adults participating in the survey (Appendix A) and two statements of informed consent were constructed for the child survey. One statement was directed toward the child being interviewed (Appendix B), and the other was for the parents of the child to give permission for their son or daughter to be interviewed (Appendix C). The purpose of the informed consent documents was to explain that the interviewee was under no obligation to answer the survey questions, and that the answers that the interviewee gave would never be used in conjunction with the identity of the interviewee. Also included in the informed consent message was a statement that encouraged survey participants to ask for clarification if the meaning of the question was unclear. These statements were written in the simplest way possible so that they would be easy for the interviewee to understand, and not overly official, which would be potentially intimidating. Since it was not culturally appropriate to ask the interviewees to sign an informed consent document, the translator verbally explained the situation and asked each participant if he or she would agree to take the survey.

Household Survey

The survey for families, (a questionnaire) followed an oral interview format, since many of the people in Burkina Faso are not comfortable reading and writing. The survey

contained four sections, for a total of twenty-nine questions (Appendix D). Once a family agreed to answer the questions, the initial estimate of time to be spent on each interview was thirty minutes.

Child Survey

The survey for children was also simple questionnaire, with sixteen questions about their daily routine, experiences at school, and the connections between life at home and at school. The children were to be interviewed individually for twenty minutes each in order to answer the survey questions. To keep the children engaged, picture cards were created to be shown with certain questions. For instance, when the surveyor asked what supplies the child brings to school, he or she would show the child a card with pictures of notebooks, pencils, a slate, a ruler, and a backpack. The cards were meant to suggest to the student the type of answers that was being sought, without limiting the students to respond only with the items that were pictured on the card. Cards were also created to use with the questions about siblings and other family members, and about the food that they eat (Appendix E).

Teacher Survey

Since it was anticipated that the surveys for children and families would be relatively time consuming, it was decided that the teacher survey would be conducted in a written format. The survey contained thirteen brief questions (Appendix F) for the teachers to read and answer, and the approximate time needed to complete the survey was twenty minutes. The teachers could all fill out this survey at the same time, after they received the initial instructions, and the survey packets could simply be collected when the teachers were finished. It was assumed that the population of teachers was literate, so

speaking with each teacher individually was not necessary, although doing so might have given more detailed results. These survey designs were developed during the fall semester based on the models of other studies, and the survey literature that had been read. Despite the research and preparations that had been made during the fall 2008 semester, it was understood that when the survey was administered in January, some modifications to our process might be necessary.

Literature Review for Data Analysis

For a study in which the sample will be relatively small and there is minimal prior information about the population, it is important to recognize the exploratory nature of the data analysis (Hoaglin, Mosteller & Tukey, 1983). Exploratory data analysis uses “robust and resistant methods” to understand the data and the patterns that it shows, instead of forcing it to follow a preexisting model (p. 1). Robust techniques can accurately show certain characteristics of the data being analyzed, even if there are some slight violations of the assumptions of the probabilistic model being used to examine the data. Methods that are resistant are not strongly influenced by “minor perturbations in all the data, [or] drastic shifts in a small fraction of the data” (p. 2). One of the best ways to observe patterns in exploratory data is through visual presentation. Stem and leaf displays and boxplots are some of the most useful tools for graphically describing quantitative batches of data. The stem and leaf display shows the overall shape of the sample, while maintaining the actual data values of the sample. According to Emerson and Hoaglin (1983), the advantages of using a stem and leaf display are that they show the symmetry and spread of the data, the existence of possible outliers, and the places in the distribution of the sample where data is clustered or absent. Two stem and leaf

displays can be compared in a back-to-back arrangement, but for comparing several batches of data, the boxplot is an effective instrument. Emerson and Strenio (1983) explain that the boxplot uses summary values of the sample data to show the location, spread, skewness, and any outlying values of the data (p. 58). The boxplot is a resistant tool because it uses the median and quartiles of the data, which are not influenced strongly by extreme data values. The resistance of the boxplot makes it a good tool for analyzing batches of data since outliers may be difficult to determine when the sample size is small and little information is known about the population parameters. Both the stem and leaf plot and the boxplot are helpful visual displays for understanding exploratory data. To present the quantitative findings from the Mahadaga education assessments, boxplots and stem and leaf plots were employed to begin investigating characteristics about the population.

Boxplots and stem and leaf plots are effective methods of presenting quantitative data, but other methods of display are required for qualitative data. Bar graphs are appropriate for displaying simple frequency information about certain variables, but they cannot describe more than one variable at a time for each subject of a sample. Cognitive mapping and repertory grids can be used to present qualitative observations, but these techniques are complex and time consuming to implement. A statistical presentation method, called Chernoff Faces, has been used to analyze *quantitative* data, but in a study connecting socioeconomic status with reading habits in Belém City, Brazil, Barbosa et. al. (2006) show how *qualitative* variables can also be described using this technique. Chernoff Faces are diagrams in the shape of human faces in which each facial characteristic is assigned to a variable of interest in the study (Flury & Riedwyl 1981). In

the original application of the faces, the quantitative parameters of the study were connected to an algorithm for the shape, size, or position of each facial feature.

However, Barbosa et. al.'s study shows that qualitative variables that are divided into levels or groups can also be assigned to facial characteristics that can be compared across individuals within the sample. Chernoff Faces provides a visual display of multivariate data and a method for quickly identifying extreme data values in certain individuals. This technique also hints at connections between variables to motivate deeper investigations of relationships within the population.

Fieldwork (January 2009)

Conducting the Household Survey

Collecting the Sample

To ensure that the sample of families in Mahadaga would be an accurate representation of the village as a whole, Dr. Hare divided Mahadaga into three regions: North, Central and South. Each region was approximately two kilometers of the village's main road, as well as the area on either side of the road. The "North" region was the area to the north of the SIM missionary housing compound & medical clinic. The "Central" region was the area between the SIM compound and the CAH. The "South" region was south of the CAH. Students worked in teams of two to map each region (Appendix G). The team in the North region began at the SIM compound and walked north for ten minutes at a moderate pace. After ten minutes, they turned around and walked back in the direction from which they came, until they reached a path on either side of the road. Upon finding an entrance to a path, the team flipped a coin to determine if they would walk down the path or not. If the number side of the Burkinabè coin landed face-up on

the ground, the team would walk down the side path for ten minutes. If the path split in multiple directions, the team always took the largest path. After ten minutes, the team turned around and walked back toward the main road. As they retraced their steps to the road, the team drew the shape of the path and marked down the location of any compounds along it. The team repeated this procedure until they had mapped three paths from the main road. The teams mapping the other regions followed this same procedure, beginning at their own starting locations. The team mapping the South region began at the CAH and walked ten minutes south of there. The team mapping the Central region began at the SIM compound and ended at the CAH.

Once three paths of compounds were mapped for each region, the compounds were assigned numbers within their region. Households from each region would be selected for interviews by a random number generator on a calculator. With this sampling process, a random sample of 10 families was selected. Three families came from the South region and the Central region, and four families were chosen from the North region. A slightly higher proportion of households came from the North region since that is the most populated part of Mahadaga.

Interviewing Families

In January, the ten household surveys were conducted based on the design that had been developed in the fall 2008 semester. The interviews in Mahadaga took place between January 12 and 15, 2009. Often, the head of the household answered the survey questions, but in the few cases where the head of household was not present, another adult was interviewed. The interviewee responded to the questions in the survey (Appendix D), and upon completion of the survey, the interviewer offered to take a

digital photograph of the family and print it for them using a portable printer. The interview was conducted in French, Gourmanche or Fulfide, based on the preference of the interviewee, and this was translated into English so that the responses could be recorded. All of the answers given by the interviewees were written down while the survey was in process. (See Appendix H for household survey raw data.)

Modifications

In the field, some modifications were made to the survey to accommodate time constraints, survey question clarity, and cultural factors for the people interviewed. The following alterations were made during the survey process:

- Request general information about relatives living in the household instead of the name of each family member (Names required too much time to record, and it was decided that this information was a vital part of the questionnaire.)
- Omit all questions regarding ages of persons, except for the age of the head of the household (A person's age is not a memorized piece of information in Burkinabè culture, and much time was spent by the interviewee calculating the ages of family members.)
- Omit the question about the means of transportation that children use to get to school (After the first few surveys, it was clear that all children walk to school, so it was unnecessary to spend time asking this question.)
- Omit the question about how often children attend school (It was clear that children who are enrolled in school attend nearly every day that school is in session.)
- Omit the question about how children obtain school supplies (This question caused some confusion because all children's school supplies are provided by their family.)

Conducting the Child Survey

Collecting the Sample

The first child survey was conducted outside of the CAH during their midday recess. The child whose responses were recorded was the first child to answer the initial question of the survey loudly and clearly enough so that the person translating could understand her. The other surveys of children were completed in the library when another group of Messiah students selected children to help them create captions for a picture book. This sample of students from the CAH was collected by selecting students who walked up to one of the Messiah students and gave evidence that he or she could hear, see and speak. The students from Messiah wanted to have approximately equal numbers of boys and girls, so they sought more girl students to join the group.

Modifications

The children's survey was the shortest survey of the three that were conducted, and the information that it would provide was meant to augment the household survey by gaining a child's perspective on education and daily life. As a result of these limited purposes for the survey and the difficulty in obtaining a random sample of students or an environment conducive for interviewing, most of the time in Mahadaga was devoted to the household and teacher surveys. Only four child surveys were conducted, and even then, not all of the questions were answered. Since many children crowded around the interviewer at one time, and most of them were speaking at once, the children's survey needed changes to simplify it for the child whose responses were being recorded. The interviewer also dispensed with the picture cards that were designed to accompany the

child survey because they would have increased the commotion of the children present but not being surveyed, which would have further distracted the interviewee.

Conducting the Teacher Survey

Collecting the Sample

The teachers' survey was conducted at the start of a *one-day, 2 hour* workshop for teachers, led by Messiah students, about incorporating technology and math-related games into their classrooms. The attendance at this workshop was optional for any teachers from the CAH or the public and private primary schools in Mahadaga. A group of ten teachers from these three local schools came to the seminar and spent approximately the first twenty minutes of the session answering the survey questions. All three schools were represented at the workshop, with four teachers from the public school and three teachers each from the CAH and private school. (See Appendix I for teachers' survey raw data.)

Analysis of Results (Spring 2009)

Quantitative Analysis

The first step in analyzing the raw data from the surveys was presenting the quantitative data. The methods that had been researched in the fall 2008 semester that were considered to be the most helpful were the boxplot and the stem and leaf plot.

Boxplots

In this analysis, boxplots were developed according to the process described in *Understanding Robust and Exploratory Data Analysis*. This method uses fourths and the "fourth-spread" to determine the center fifty percent of the data (Emerson & Strenio, 1983). To construct a boxplot, the values of a batch of data are listed in ascending order,

and from this list, five particular values are determined to create a plot of the data. The median, or middle, data value of the n data values in the batch is selected when n is odd, and it is marked by the center line on a boxplot. If n is even, then the arithmetic mean of the two middle values is used to calculate the median. Once the data is divided in half by the median, the lower fourth is calculated by finding the median of the lower half of the data, and the upper fourth is the median of the upper half of the data (Hoaglin, 1983). If n is odd, then it is included in each half of the data values when the fourths are determined (Devore, 2004). If n is even, the median is not included in the calculations for the fourths. If the number of observations in the halves of the data is even, then the arithmetic mean of the two middle observations of each half is used as the value of each of the fourths. The fourths are also designated by lines on the boxplot that are parallel to the median line. These three lines are connected to form a box with a line dividing its interior into two sections. Perpendicular to the lines of the fourths, a “whisker” is drawn on either side of the boxplot to the lowest and highest data values from the batch that are not deemed as outliers. Hoaglin (1983) explains that in a small batch of data, it is difficult to determine outliers, but a formula using the fourth-spread can be used to determine any “outside values”, which are observations that tend to one extreme of the data set and may possibly be outliers. The outside values are those which are a distance of 1.5 times the length of the fourth-spread below the lower fourth or above the upper fourth (Hoaglin, 1983). The quantitative variables that were analyzed in the household survey were:

- Number of adults living in the household
- Age of head of household

- Number of children living in the household
- Number of children attending school
- Number of food groups in the diet of the household

Figures 1-8 present this data using boxplots. The boxplot for the number of adults living in the household (Figure 1) shows that the data set is skewed to the right, which indicates that most of the households have fewer than ten adults, but some households surveyed have as many as fourteen adults living in the household. In this case, the mean number of adults living in a household would be greater than the median value of 7 because of the presence of a few high values in the sample. As Emerson & Strenio (1983) point out, the median is a more resistant measure of center than the mean.

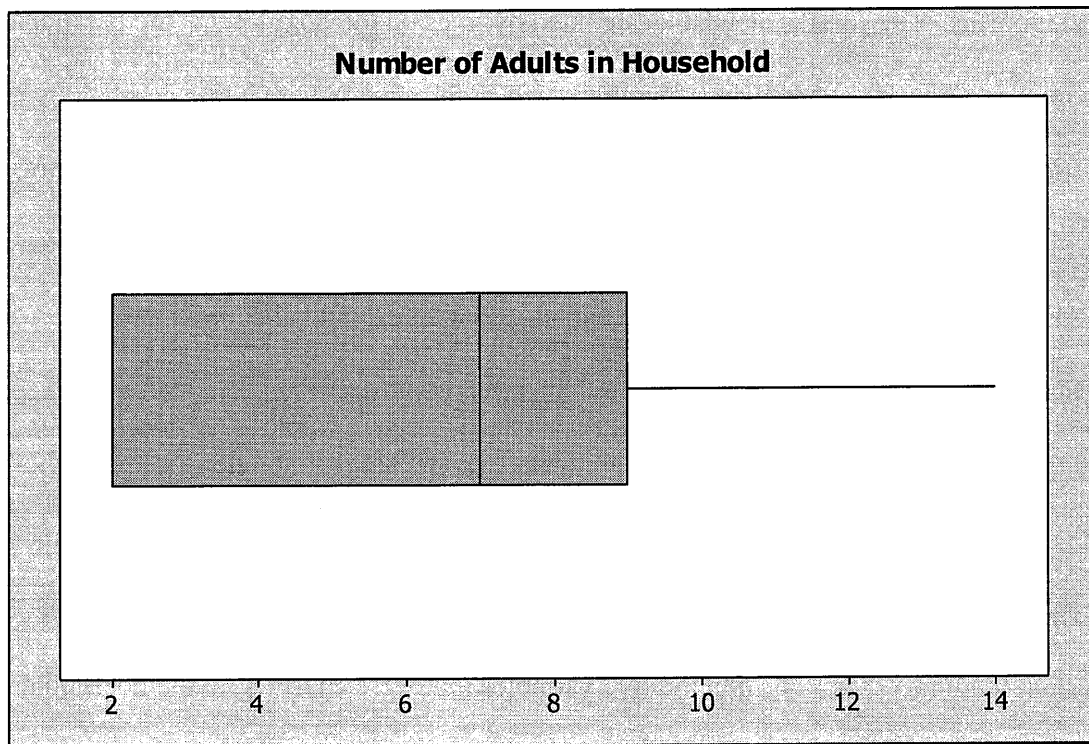


Figure 1*

* All boxplots were created using MINITAB® v 15

The boxplot for the age of the head of household (Figure 2) shows a distribution that is approximately normal. The median is almost in the center of the boxplot, and the whiskers on either side are approximately the same length. This shows that most of the heads of household surveyed are between the ages of thirty-five and sixty-five, but there are some heads of household who are as young as twenty-four, and others as old as eighty.

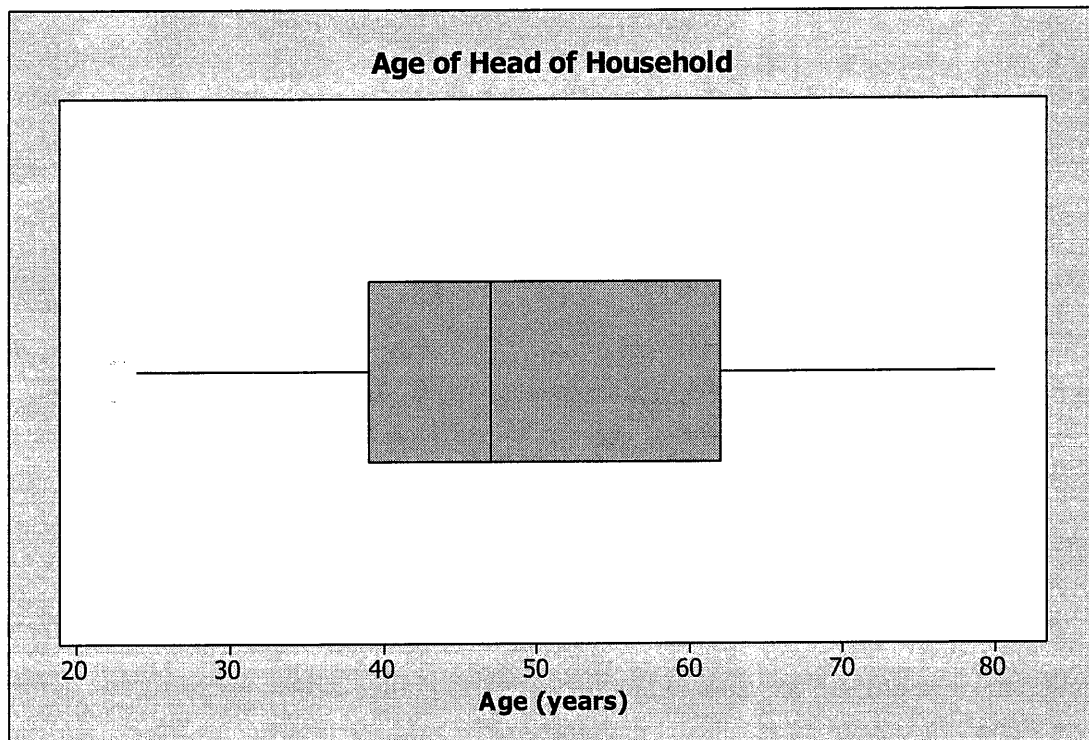


Figure 2

The boxplot of results for the number of children living in the household (Figure 3) is skewed to the left, which shows that most households tend to have more than five children. The fewest number of children in a family survey was two, and the highest number reported was twelve. This boxplot used nine values instead of ten like the other graphs because one family responded that they had too many children living in the household to count them all.

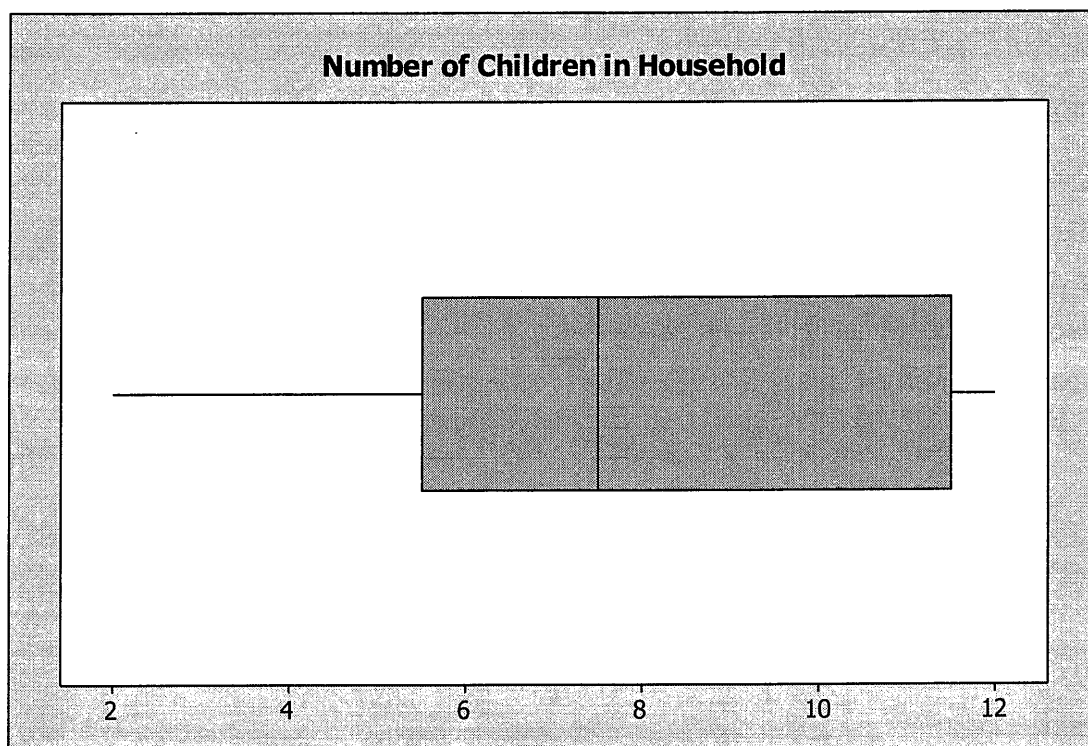


Figure 3

The number of children from each household who attend school is shown in Figure 4.

The range of school enrollment goes from zero children in school to ten children in school. These numbers are slightly smaller than the numbers from Figure 3, which show the numbers of children in a household. Part of the reason for the decrease is that children must be at least six years old to attend school, but when we asked for the number of children living in a compound, we only asked for the total number of children rather than the number of children of school age.

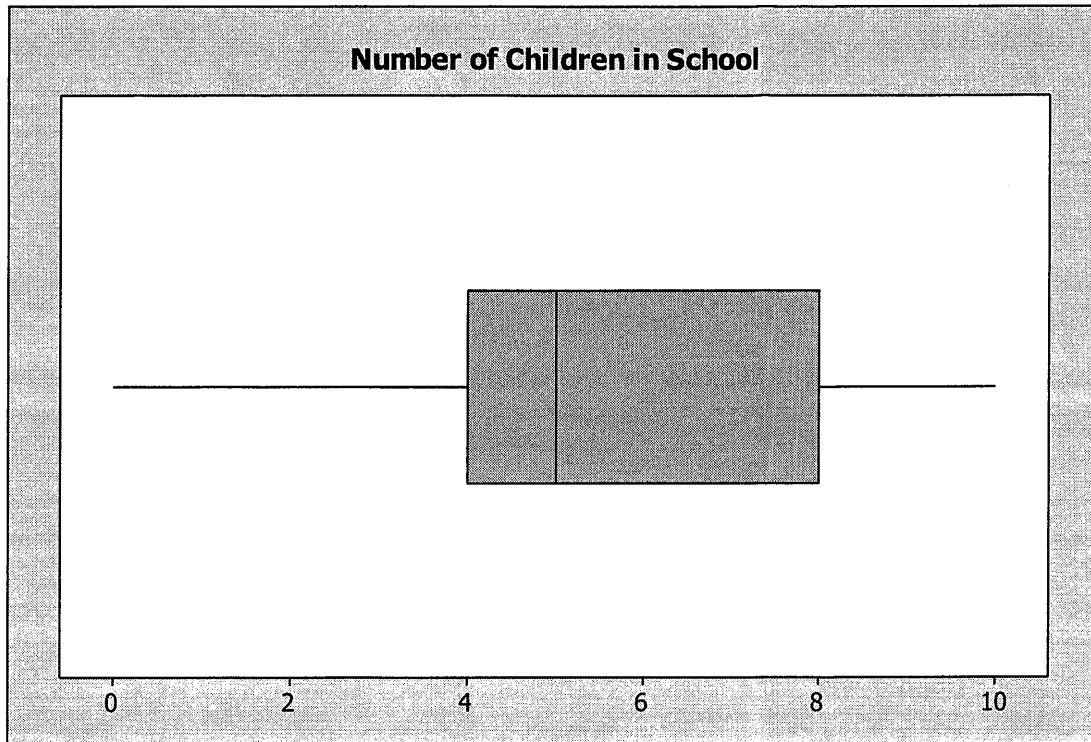


Figure 4

Another variable of interest in this survey was the nutrition level of the population.

Information from the Food and Agriculture Organization of the United Nations shows a list of foods that people in West Africa should try to include in their diet to optimize their health. The foods mentioned on this list were divided into five groups based on the food available in Mahadaga. Figure 5 shows that most of the families eat between two and four food groups, but some eat as few as one, and others eat as many as five. The five food groups used for categorizing the variation of diet among the families were cereals, beans, meat and eggs, fruits and vegetables, and dairy. Cereals were the only food group which was included in every household's diet.

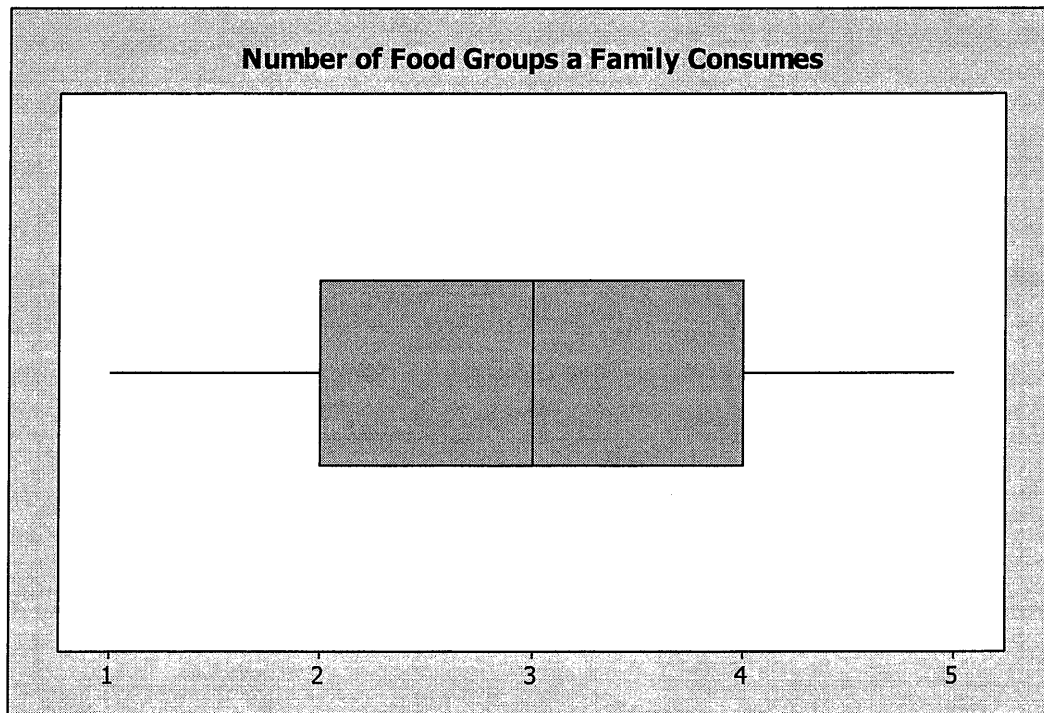


Figure 5

One variable that was measured with the teachers' survey was the number of male and female students in a classroom (Figure 6). Side by side boxplots were used to show how the distributions of school attendance differ between boys and girls. These graphs show that there are slightly more boys in a class than girls, although both groups have a median that falls around 42 students in a classroom.

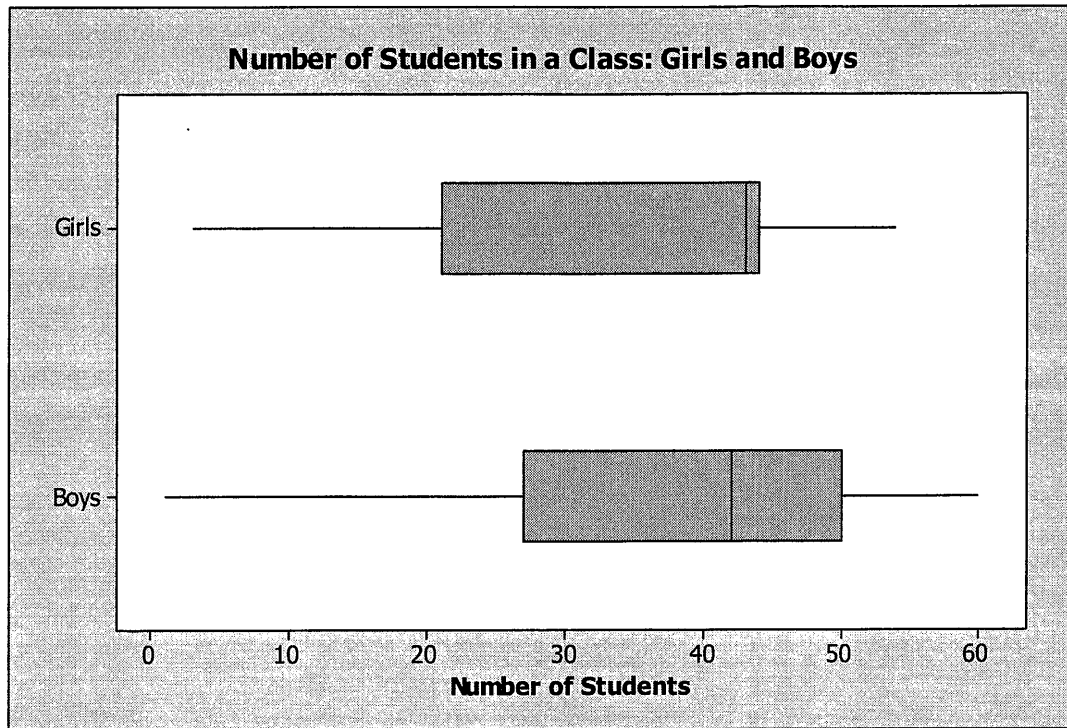


Figure 6

One of the objectives of the teachers' survey was to gather information about the education and experience of primary school teachers. Figure 7 shows the total number of years of experience that the teachers have, and Figure 8 shows their years of experience at their present school. Approximately half of the teachers have had four to eight years of total teaching experience, although some have had as many as twelve, and others have only started their teaching career a year ago. The range of years that teachers have spent at their present school is slightly lower than the range for total years of teaching experience, which indicates that some teachers have gathered teaching experience from multiple schools.

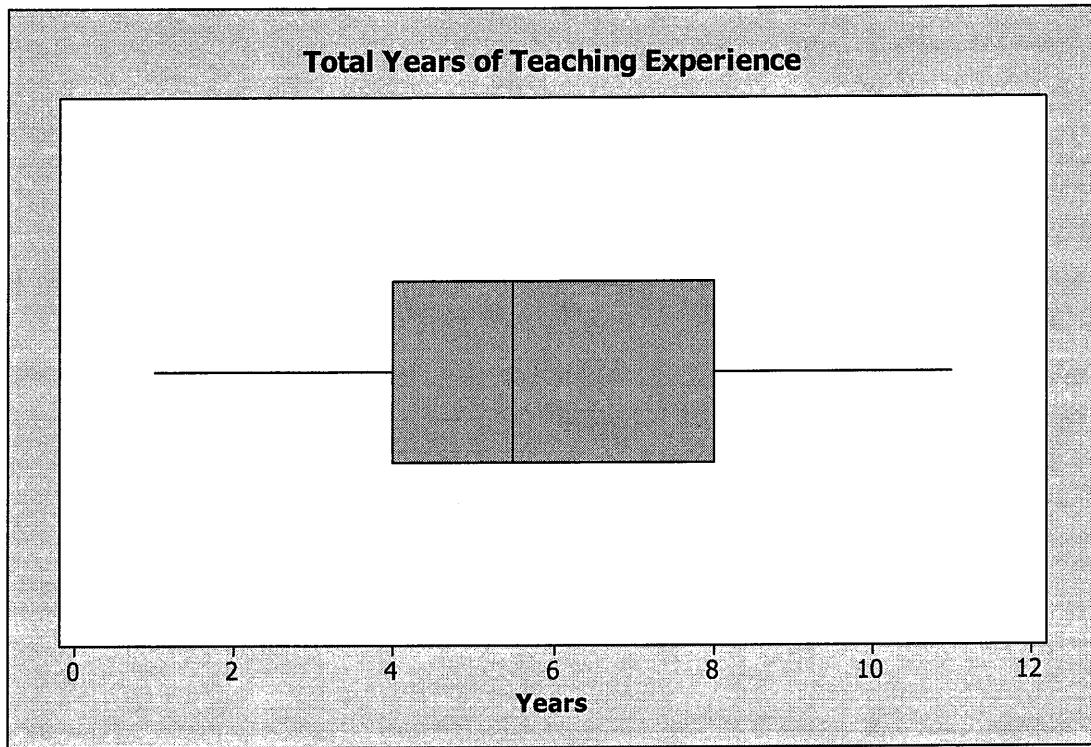


Figure 7

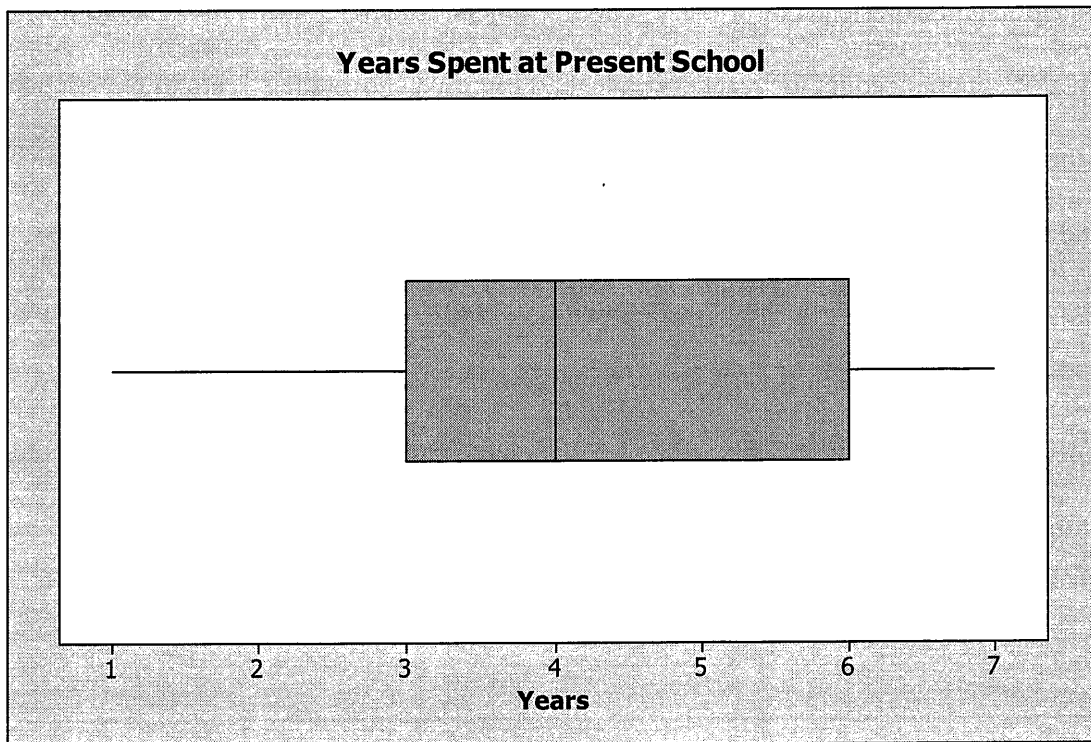


Figure 8

Stem and Leaf Plot

In addition to boxplots, *Understanding Robust and Exploratory Data Analysis* advocates the use of stem and leaf plots for displaying batches of data. Emerson and Hoaglin (1983) do not give specific procedures for developing a stem and leaf plot, but they do suggest a limit for the number of lines the plot should have in order to present the data effectively. The formula for the maximum number of lines is:

$$L = [10 \times \log_{10} n]$$

Where n is the number of observations in the batch, and $[\cdot]$ is the floor function.

Figure 9 shows the stem and leaf plot that was developed using data from the household survey. Percentages of children attending school for each household were calculated, and the numbers were color coded based on the tribe that the household belongs to. It is obvious from the stem and leaf plot that Gourmanche families send higher percentages of their children to school than Fulani families do.

Primary School Attendance Rate

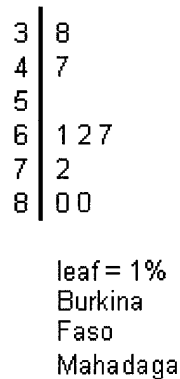


Figure 9

Qualitative Analysis

Bar Graphs

One of the basic qualitative data display methods used for the data from the teachers' surveys is the bar graph. Bar graphs compare frequencies of variables, and they are simple to understand, even for people with no statistical background.

Figure 10 shows a double bar graph comparing the subject preferences of teachers. This graph shows that teachers have both positive and negative strong feelings towards teaching math and strong negative feelings towards teaching history.

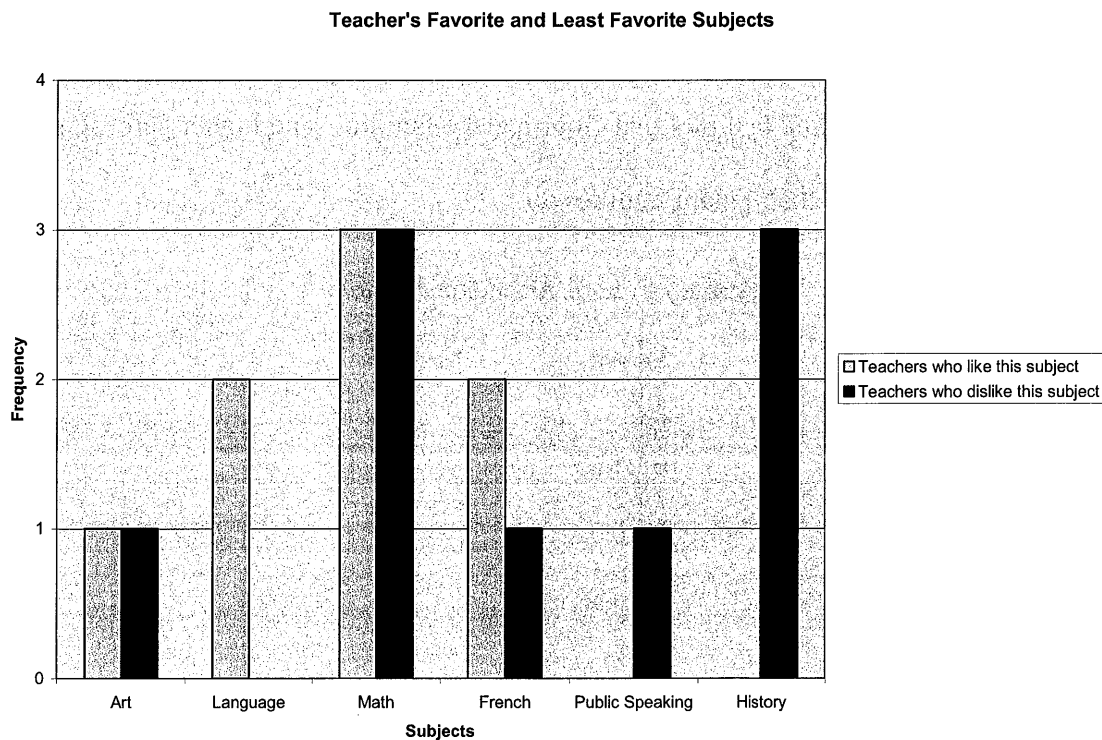


Figure 10

Another bar graph was created to show the frequencies of the most common physical disabilities that children in Mahadaga have (Figure 11). This bar graph is stacked to

show which schools children with these disabilities attend. This graph shows that difficulty hearing is the most common disability among children in Mahadaga, and all children who have this disability attend the CAH. All children who have a vision impairment also attend only the CAH, whereas some children with difficult walking or speaking attend the schools other than the CAH.

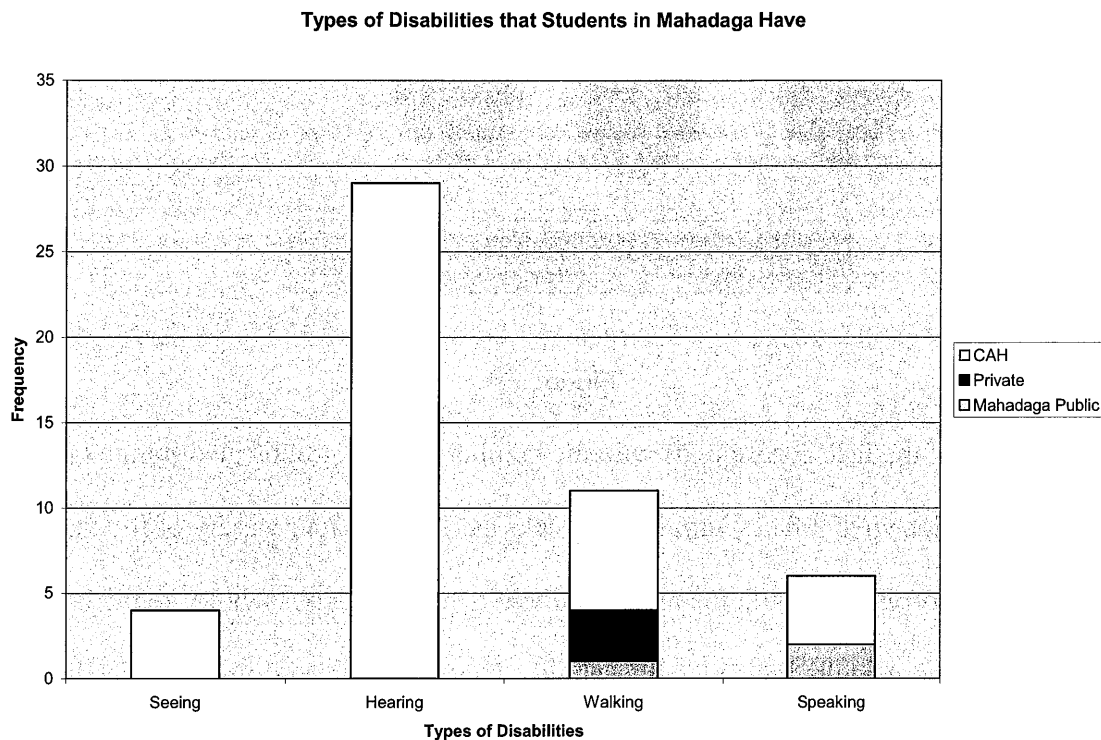


Figure 11

Chernoff Faces

The main technique used for qualitative analysis of the household survey was developing Chernoff Faces. This method displays several measurements of each sample observation at the same time. A picture of a human face is developed for each observation, and each variable being measured corresponds with a facial feature. Figure 12 shows all ten faces and a key for the facial features.

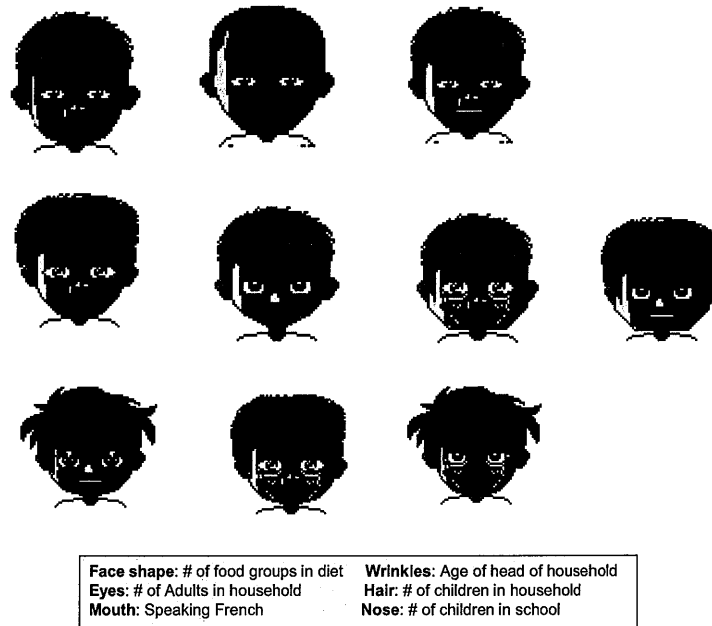


Figure 12*

The fullness of the face corresponds with the number of food groups incorporated into the household's diet, so that faces with fuller cheeks eat from a wider variety of food groups. The eye size corresponds with the number of adults living in a household, so the larger the eyes, the more adults live in the household. The mouth is determined by whether the family speaks French at home. If French is spoken in the household, the mouth is open, and if the family does not speak French, the mouth is closed. The amount of wrinkles on a face corresponds with the age of the head of the household. The more wrinkles that are on a face, the older the head of the household is. The length of the hair corresponds with the number of children living in the household. Households with the most children have the longest hair, and households with the least children have the shortest hair. The size of

* All Chernoff Faces were created using "Portrait Avatar Maker"

the nose is related to the number of children in a household who attend school. The larger the nose is, the higher the number of children there is attending school.

In order to compare the faces, a set of five “lenses”, or variables of interest, was developed for viewing the faces. Faces were categorized according to each lens, and observations were made about trends in facial features for the grouped faces. The variables of interest were:

- The tribe of the household
- The occupation of the household
- The presence / absence of a child with disabilities within the household
- The type(s) of schools children attend
- The gender of the head of household

Figure 13 shows the faces divided according to their tribe, and Figure 14 shows the division based on occupation. From these two categorizations together, it was clear that all of the Fulani families are shepherds and all of the Gourmanche families are farmers. In Figure 14, faces of Fulani families who are shepherds are circled in red, and faces of Gourmanche families who are farmers are circled in blue. One face is repeated on the farming side is outside of the blue circle, because that face belongs to a Fulani family. That particular family does some shepherding and some farming, so that face is represented under both occupations.

Chernoff Faces: Tribe

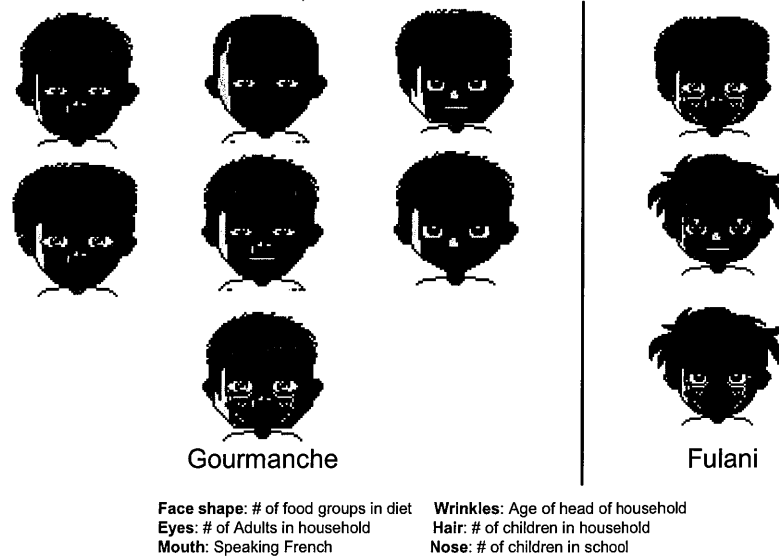


Figure 13

Chernoff Faces: Occupation

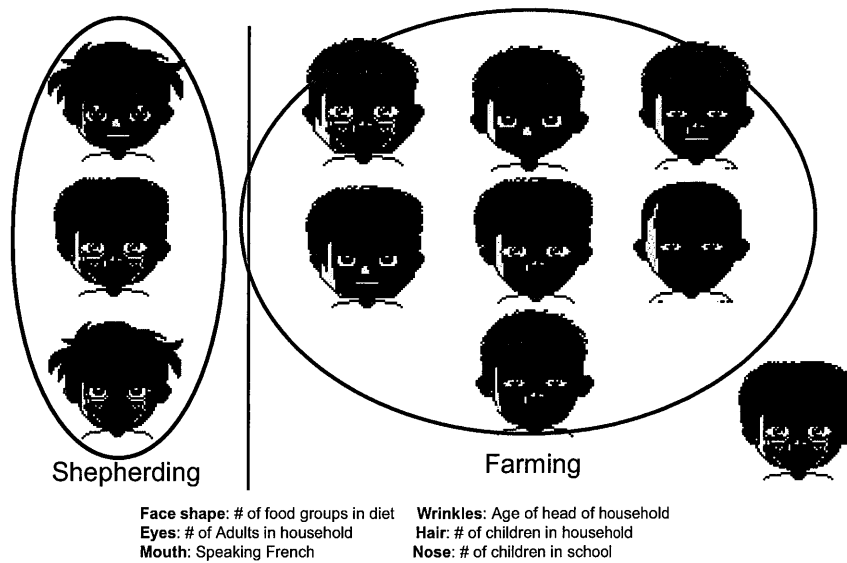


Figure 14

Figure 15 shows the division of the faces based on whether a family has a child with disabilities living in the household. Half of the families surveyed have a child with disabilities, and the other half do not. By separating the faces according to this characteristic, it is clear that faces of families that have a child with disabilities tend to have short hair, which corresponds with fewer children in the household overall. The families who do not have a child with disabilities tend to have more children in their household, which is shown by the longer hair on those faces.

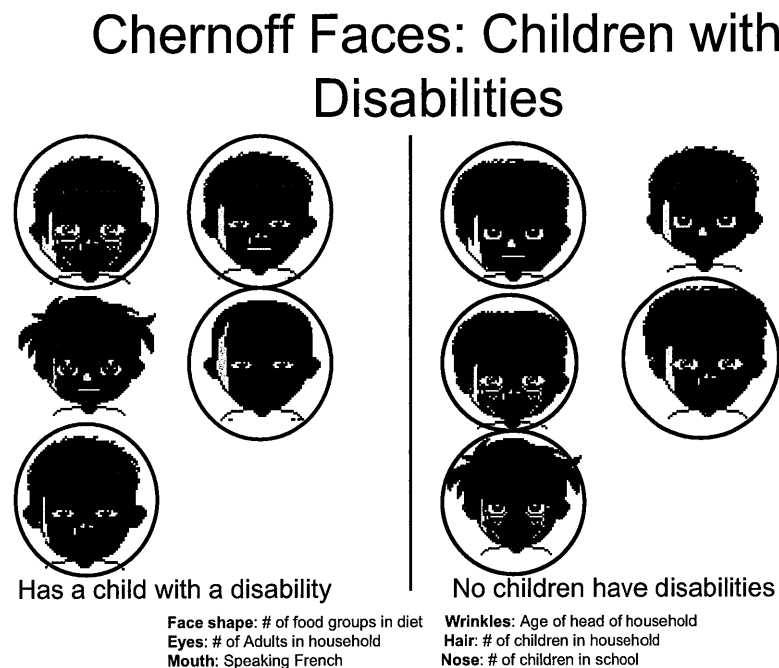


Figure 15

The group of families that have a child with disabilities could be further separated into two groups. Some families in Mahadaga allow children with disabilities to board with them so that those children have better access to the CAH than if they were living with their own family. Figure 16 shows the split of families whose child with disabilities is a boarder and those families whose child with disabilities is a member of the family. From

this display, one can see that families who have a child with disabilities who boards with them tend to have few adults in the household, (shown by the smallest eyes). Faces that belong to families whose child with disabilities is a related member of the family tend to have large eyes, which means there are many adults living in that household.

Chernoff Faces: Children with Disabilities

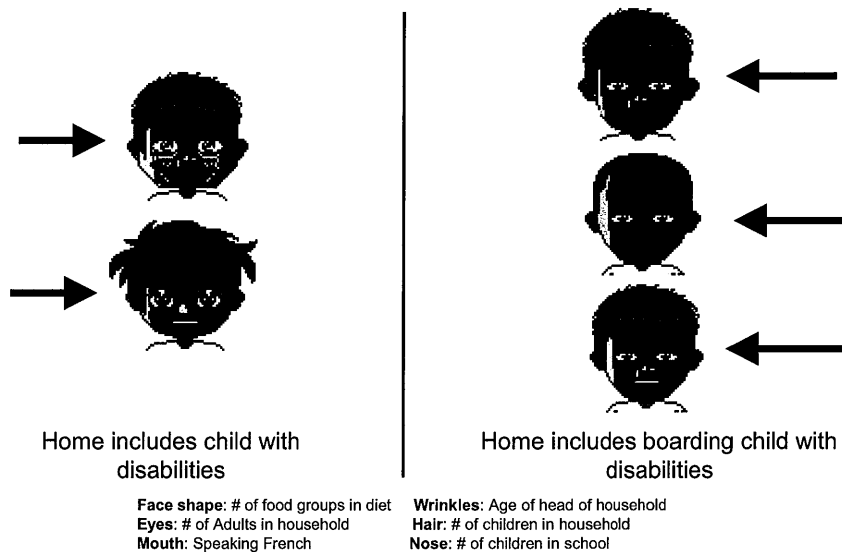


Figure 16

The next lens for viewing the faces was the gender of the head of household. Slightly over half of the families have a male head of household. As shown by the circled faces in Figure 17, all of the families that speak French have a male head of household.

Chernoff Faces: Head of Household

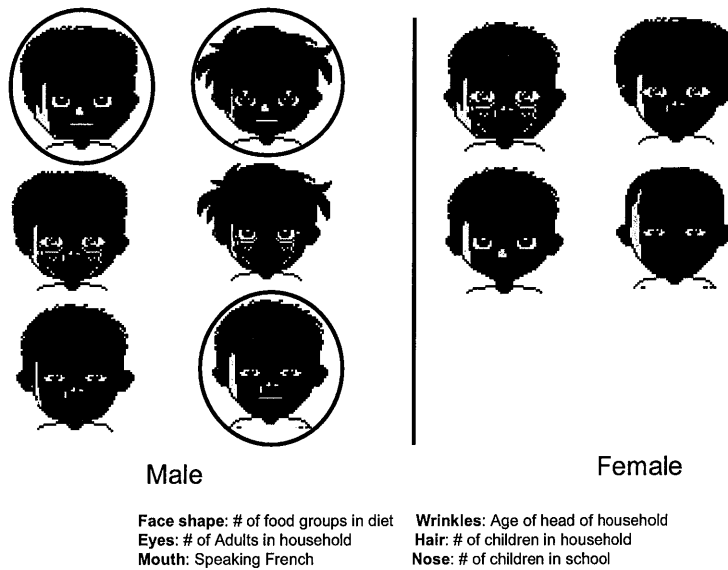


Figure 17

The other lens that was used to categorize the data was the types of schools that children in a household attended. The schools that children from one family could attend were the public school, private school, CAH, or any combination of these three. No conclusions were able to be drawn from this lens because there were too many possible combinations of schools that children from one family attend to make comparisons between families.

After classifying the faces according to the “lenses” that were chosen, the faces were also analyzed according to each facial feature. Figure 18 shows the faces categorized by their eye size. The faces on the far left have the smallest eyes, and the face on the far right has the largest eyes. As shown by this diagram, faces with the smallest or second-smallest eyes tend to have short hair. Faces with the largest or second-largest eyes tend to have long hair. This means that households with few adults tend to have few children, and households with many adults tend to have many children.

This relationship between numbers of children and adults in a household was also revealed in the division of faces by the hair length.

Chernoff Faces: Sizes of Eyes

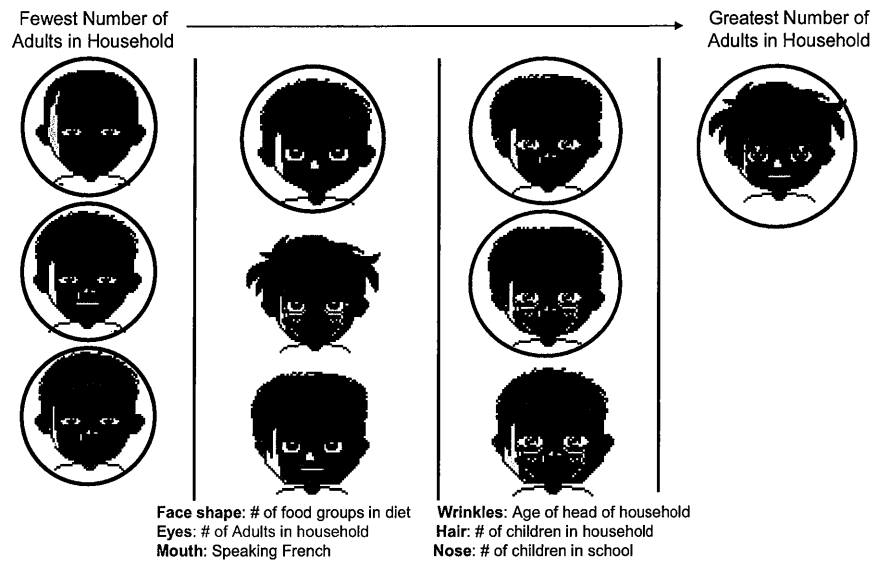


Figure 18

In the division of faces by the type of mouth (Figure 19), it is shown that the majority of families that speak French have the highest amount of children in school, depicted by the largest nose. The other family that speaks French has the second-largest nose, which indicates that the number of children attending school in that family falls within the second highest range of attendance.

Chernoff Faces: Type of Mouth

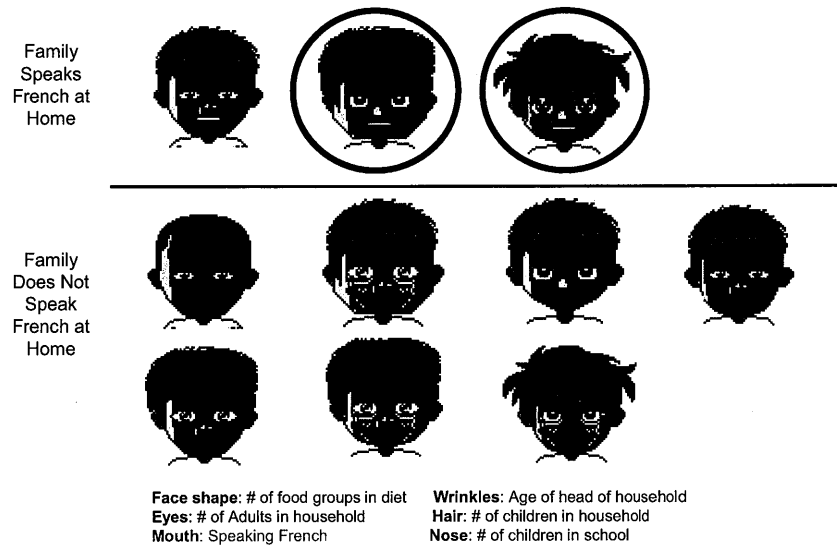


Figure 19

The last facial feature that displayed a relationship between variables is the amount of wrinkles on the face. The amount of wrinkles corresponds with the age of the head of household. Figure 20 shows that most of the families with the youngest heads of household send the highest numbers of children to school.

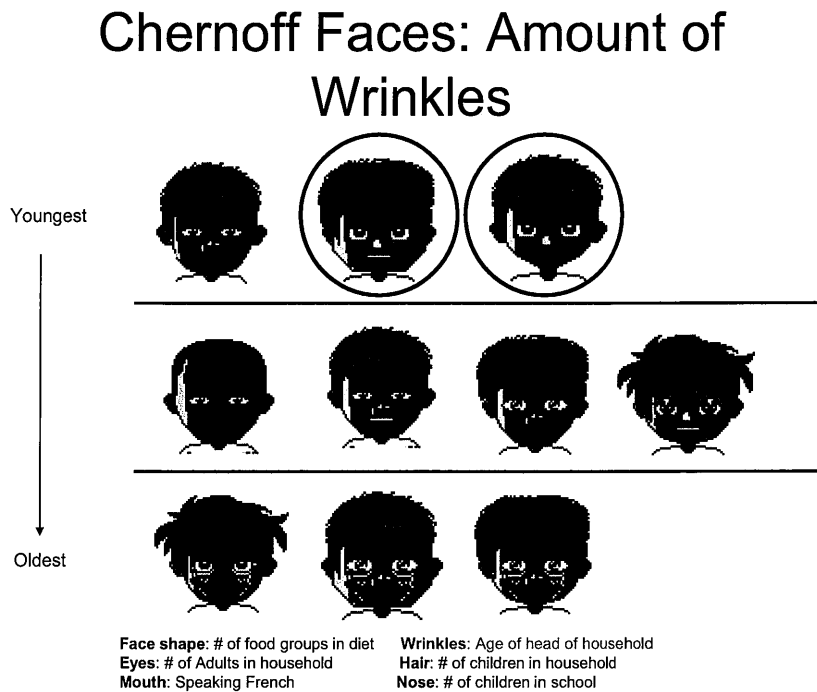


Figure 20

The Chernoff Face method of analysis made it possible to use multi-variable, qualitative data that was broken down into levels of a variable to compare several characteristics of the sample. Relationships between variables came to the surface when the faces were grouped, which provides the baseline data sought by the survey.

Conclusions

During the spring 2009 semester, statistical tools that had been researched during the fall semester, including boxplots, stem and leaf plots, bar graphs, and Chernoff Faces

were used to display the data from the surveys. Based on these displays, the following conclusions about Mahadaga from the survey responses became apparent:

- Families who have a child with disabilities tend to have fewer children in the household and vice versa
- Households who have a child with disabilities who is a boarder tend to have the fewer adults than households who have a child with disabilities who is a member of the family
- Families with the fewer adults in the household tend to have fewer children and vice versa
- The number of adults in a household seems to be skewed to the right, and the number of children seems to be skewed to the left
- Families who speak French in their homes tend to have a large number of children attending school
- Families with a younger head of household tend to have more children attending school
- Gourmanche families tend to have a higher percentage of their children in school than Fulani families
- Teachers tend to have strong positive or negative feelings about teaching math, and strong negative feelings toward teaching history
- The most common disability affecting children in Mahadaga is audio impairment
- Children with difficulty hearing or seeing seem to attend only the CAH

These conclusions will give future Education Group members a better understanding of the culture in Mahadaga as they continue to partner with the CAH and other educators in the village.

Suggestions for Future Research

After this survey was conducted and analyzed, it was clear that there are opportunities for future research about education in Mahadaga. One possible course of action would be to interview the teachers in a similar fashion to the household survey conducted in this study. Oral interviews would gather clearer and more detailed answers, and they would help to build deeper relationships between teachers in Mahadaga and students in the Education Group.

As mentioned earlier, the North region of Mahadaga is the most populated part of that village. At this time, it is unknown how many people live in that area. A survey of population could be conducted in the future to make an estimate of the number people who live there. This information would be useful for education officials to know regarding the number of children who could be in school, and for the CAH officials who provide services for people with disabilities.

Another area of research that could be expanded is the survey for children. Due to the limited amount of time spent in Mahadaga during January of 2009, the interviewers focused on conducting the household and teachers' surveys. Insufficient data was collected from the children's survey to make any comparisons or conclusions about that population group. If this survey is conducted in the future, it would require a controlled environment so that the interviewer would be able to speak to a child one-on-one, without many other children crowding around the interviewer and speaking at the same time. A

child's perspective on education is not one that is frequently heard in that culture. It would provide deeper insight into the educational system if children's ideas could be heard, and perhaps compared with the thoughts of adults that were gathered in this survey.

References

- Barbosa, R. C. C., Ramos, E. M. L. S., Araújo, A. R., & Almeida, S. S. (2006).
Evaluating the socioeconomic relations with reading habit between the students
from a particular school and a public school. *ICOTS*, 7, 1-4.
- Cassell, C. & Symon, G. (Eds.). (2004). *Essential guide to qualitative methods in
organizational research*. London: Sage.
- Flury, B. & Riedwyl H. (1981). Graphical representation of multivariate data by means of
asymmetrical faces. *Journal of the American Statistical Association*, 76, 757-765.
Retrieved November 11, 2008, from JSTOR database.
- Food and Agriculture Organization of the United Nations. (2008). *Food-based dietary
guidelines: Nigeria*. Retrieved February 17, 2009, from
<http://www.fao.org/ag/humannutrition/nutritioneducation/49849/en/nga/>
- Handicap International, Messiah College, World Vision, & The Conrad Hilton
Foundation (2007). *Study on access to water, hygiene and sanitation for people in
a disabling situation in Mali (region of Tominian)*. Washington, DC: Author.
- Hoaglin, D. C., Mosteller, F., & Tukey, J. W. (1983). *Understanding robust and
exploratory data analysis*. New York: John Wiley & Sons, Inc.
- MINITAB (Version 15) [Computer software].
- Portrait Avatar Maker [Software]. Available from http://avatarmaker.abi-station.com/index_en.shtml
- TANGO International, Inc. & C-SAFE M&E team, (2003). *Malawi baseline survey:
Report of findings*.

UNICEF. (2007). *West and Central Africa*. Retrieved April 29, 2009, from
<http://www.unicef.org/infobycountry/centralafrica.html>

Appendix A

Consent to Participate in Research – Adult

My name is Katie Patton and I am a college student in the United States. Dr. Hare is one of my teachers. We are interested in learning about your community, and we would like to ask you some questions about your family and your life in Mahadaga. If you do not understand any of the questions, please tell us, and we will try to explain what we mean. If we ask a question that you do not want to answer, you can also tell us that, and we will pass over that question. If you want to stop answering questions at any time, you can say that. We will not tell other people what answers you gave to any of the questions. This survey will take about 30 minutes to complete. You do not have to answer our questions, but if you would like to answer the questions, please say “I would like to answer the questions.”

Appendix B

Consent to Participate in Research – Children

My name is Katie Patton and I am a college student in the United States. Dr. Hare is one of my teachers. We are interested in learning about your community, and we would like to ask you some questions about your family and the things you like to do during the day. If you do not know the answer to a question, you can ask us to explain what we mean. If there is a question that you do not want to answer, you can tell us, and we will skip that question. If you would like to answer our questions, please say "I would like to answer the questions."

Appendix C

Parental Consent for Children to Participate

My name is Katie Patton and I am a college student in the United States. Dr. Hare is one of my teachers. *(If not already shared in the adult survey.)* We are interested in learning about your community, and we would like to ask your children some questions about the things that they do during the day. Your son/daughter does not have to answer the questions if he/she does not want to, and he/she can stop answering questions at any time during the survey. If you are willing to let us ask your child some questions, please say "I am willing."

Appendix D

Household Survey

Section 1: Identification

1. Date:
2. Name of interviewer:
3. Name of the person(s) surveyed:
(Nom de la personne sur qui est fait l'enquête)
(Responsable du foyer? _____)
4. House number (assigned by Messiah College researcher): _____
5. Village: _____
6. Distance from H.e.A. center in km:
(# km qui separent le foyer du Centre Handicapé)

Section 2: Household description

Name (Nom)	Age	Gender	Relationship to household (R��lation dans le m��nage)	Children, name and age of each (nombre d'enfants, nom et l'��ge de chacun)

1. Are there children in your home who are unrelated to you and/or have another home elsewhere (you are their host family?)
(Est-ce que vous   tes une famille d'accueil pour des enfants qui n'ont pas de lien de famille avec vous?)
2. Number and age of elderly (>50 years):
(nombre et   ge de personnes   g  es, plus de cinquante ans)

3. Number and age are disabled
(nombre et age de personnes handicapées)

- a. What are the difficulties (difficulty seeing, hearing, walking, etc.,)
(Quels sont les handicaps: la vue, difficulté à entendre, difficulté à marcher, etc.)

Disability	Sight la vue	Hearing difficulté à entendre	Motor Difficulté à marcher	Other (autre) (describe)
Number of people				
Cause of disability				

- b. What is the cause of their handicap? (from birth, from disease, an accident, unknown)
(Quel est le cause de leur handicap? (de naissance, consequence d'une maladie, d'un accident, raison inconnue))

Section 3: The Head of Household (caractéristiques du chef du foyer)

1. Age:
2. Sex ____ Male ____ Female
3. Marital situation (situation de famille):

____ Married (marié)
____ Divorced (divorcé)

____ Widowed (veuf)
____ Never-married (célibataire)
4. When you were a child, did you attend school?

(Dans votre enfance, alliez-vous à l'école?)

If not, why not?

(Sinon, pourquoi pas?)

Follow-up, if yes:

For how many years did you attend school?

(Vous êtes allé à l'école pendant combien d'années?)

Has your education helped you in your life now?

(Comment votre education vous-a-t-elle bénéficié?)

5. Occupation

_____Homemaker (femme au foyer)

_____Farmer, crops (agriculteur)

_____Farmer, livestock (éleveur)

_____Merchant (commerçant)

Laborer (ouvrier)

_____Unemployed (chômeur)

Other (autre)

6. Have you ever completed a training program or apprenticeship to learn your trade?

(Avez vous jamais suivi une formation ou un stage en rapport avec votre activité?)

7. Language:

What languages do you speak?
(Quelles langues parlez-vous?)

French

Gourmanche

Fulafide

English

Section 4: Daily activities

1. On a typical day, what things do you do?
(D'habitude, pendant la journée, qu'est-ce que vous faites?)

2. On a typical day, what do your children do?
(D'habitude, pendant la journée, vos enfants, qu'est-ce qu'ils font?)

If school is not mentioned,

If there is a child in the house who doesn't go to school, what is the main obstacle to their attendance? (he/she is needed for work?)

(S'il y a une enfant chez vous qui ne va pas à l'école,
pourquoi pas? il faut qu'ils restent chez eux pour travailler)

Follow-up if school is mentioned:

- a) Which school do they attend?
(Quelle est votre école?)

- b) How do they get to school?
(Comment se déplacent-ils à l'école?)

- c) How far is the school from the home?
(Quelle distance sépare l'école et la maison?)

- d) How often do they go to school?
(Ils vont à l'école avec quelle fréquence?)

- e) What do they take to school?
(Quelles choses apportent-ils à l'école?)

- f) Do you buy their school supplies?
(Il faut acheter des choses pour l'école vous-mêmes?)

- g) Are there things you would like for them to have for school that they do not have? (Est-ce qu'il y des choses que vous voulez pour vos enfants qu'ils pourraient apporter à l'école, mais qu'ils ne peuvent pas avoir?)
- h) In your home, do your children talk about what goes on in school? (Chez vous, vos enfants, parlent-ils des choses qu'ils font à l'école?)
- i) Do you speak French with your children? (Est-ce que vous parlez le français chez vous?)
- j) What do you feel are the benefits to your child of attending school? (Quelles sont les bénéfices qu'apportent l'école à vos enfants?)

3. What are the main dishes that you eat in your home regularly? What is in those dishes? (Beans, peanuts or other nuts, watermelons, tomatoes, onions, carrots, peppers, cabbage, eggs, milk, butter, others)
(D'habitude, pendant une année, votre ménage consomme
duquels produits suivants: haricots, arachides ou autre
légumes, pastèques, tomates, oignons, carottes, poivrons,
choux, œufs, lait, beurre, autres)

Appendix E

Child Survey

Child's name and age (Nom d'enfant, age)	Names of adults living with you and their relation to you (Adults qui habitent chez toi & leur relation à toi)	Names and ages of your brothers (noms des frères)	Names and ages of your sisters (noms des soeurs)	Names, gender, age of other children (Les noms des autres enfants au foyer)

1. Do all of your brothers and sisters live in the same house as you?
(Tes frères et tes sœurs, est-ce qu'ils habitent tous chez toi?)

2. (What will you do tomorrow?)

In the morning, I will: (Dans le matin, je vais)

In the afternoon, I will: (Après lunch, dans l'après-
midi,
je vais . . .)

In the evening, I will . . . (Le soir, je vais . . .)

i. What is your favorite subject at school?
(Quel est ton sujet préférée?)

ii. Is there a library at your school?
Est-ce qu'il y a une bibliothèque à ton école?

If yes, what do you do in the library?
(Si oui, vas-tu à la bibliothèque?)

iii. Do you ever use a computer at school?
(Est-ce que tu utilises un ordinateur à l'école?)

iv. Do you eat lunch at school?
(Manges-tu ton déjeuner à l'école?)

1. (If so, do you bring lunch or is it served?)
(Si oui, tu apportes quelquechose à manger, ou l'école te donne un repas?)

2. What do you eat for lunch?
(Qu'est-ce que tu manges pour le déjeuner?)

Follow-up if school is mentioned:

- v. Which school do you attend?
(A quelle école vas-tu?)

- vi. Do you walk to school?
(Est-ce que tu vas à l'école à pieds?)

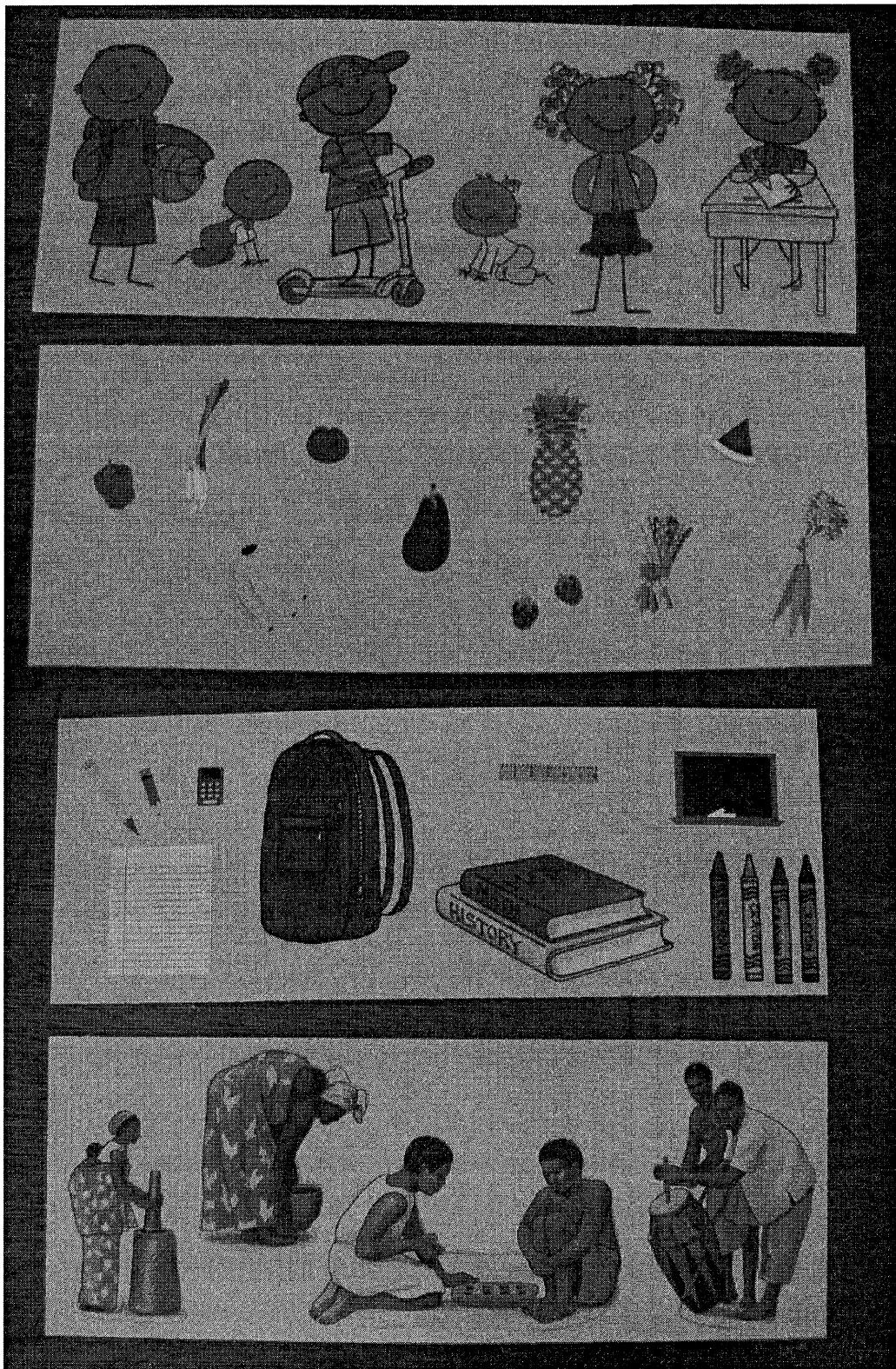
- vii. Do you go to school every day?
(Tu vas à l'école tous les jours?)
- viii. What do you take to school?
(Quelles choses apportes-tu à l'école?)
- ix. Are there things you would like to have for school that you do not have?
(Est-ce qu'il y a des choses que tu veux pour
l'école, mais que tu n'as pas?)

x. Do you talk about what goes on in school with your parents?
(Avec tes parents, parles-tu des choses que tu
fais à l'école?)

xi. Do you speak French with your parents?
(Parles-tu le français chez toi?)

xii. Do your brothers and sisters go to school?
(Est-ce que tes frères et tes sœurs vont à
l'école?)

Child Survey Picture Cards



Appendix F

Teacher Survey

Questions for Teachers

1. Name of School:
(nom de l'école)

2. How long have you been teaching at this school?
(Vous y avez enseigné depuis combien de temps?)

3. Have you taught at other schools before this one? For how many years?
(Est-ce que vous avez enseigné dans d'autres écoles avant celle-ci? Combien du temps?)

4. What grade levels do you teach?
(Vous enseignez à quels niveaux?)

Maternelle CE1 CE2 CM1 CM2 CP1 CP2

5. How many students are in your class(es) now?
(Combien d'étudiants sont dans votre classe maintenant?)

Number of girls: _____
(# femmes)

Number of boys: _____
(# garçons)

6. How many students do you have who are blind or have difficulty seeing?
(Combien de vos étudiants sont aveugles ou voient avec difficulté?)

7. How many students do you have who are deaf or have difficulty hearing?
(Combien de vos étudiants sont sourds ou entendent avec difficulté?)

8. How many students do you have who have difficulty walking?
(Combien de vos étudiants marchent avec difficulté?)

9. How many students do you have who have difficulty speaking?
(Combien de vos étudiants parlent avec difficulté?)

10. Describe your own education: where and when did you go to school?
(Décrivez votre éducation: où alliez-vous à l'école et en quelle année avez-vous reçu votre diplômes?)

11. What is your favorite subject to teach? Why?

(Quel sujet préférez-vous à enseigner? Pourquoi?)

12. What subject is your least favorite to teach? Why?

(Quel sujet préférez-vous le moins à enseigner? Pourquoi?)

13. As you prepare and teach your classes, do you often work with other teachers?

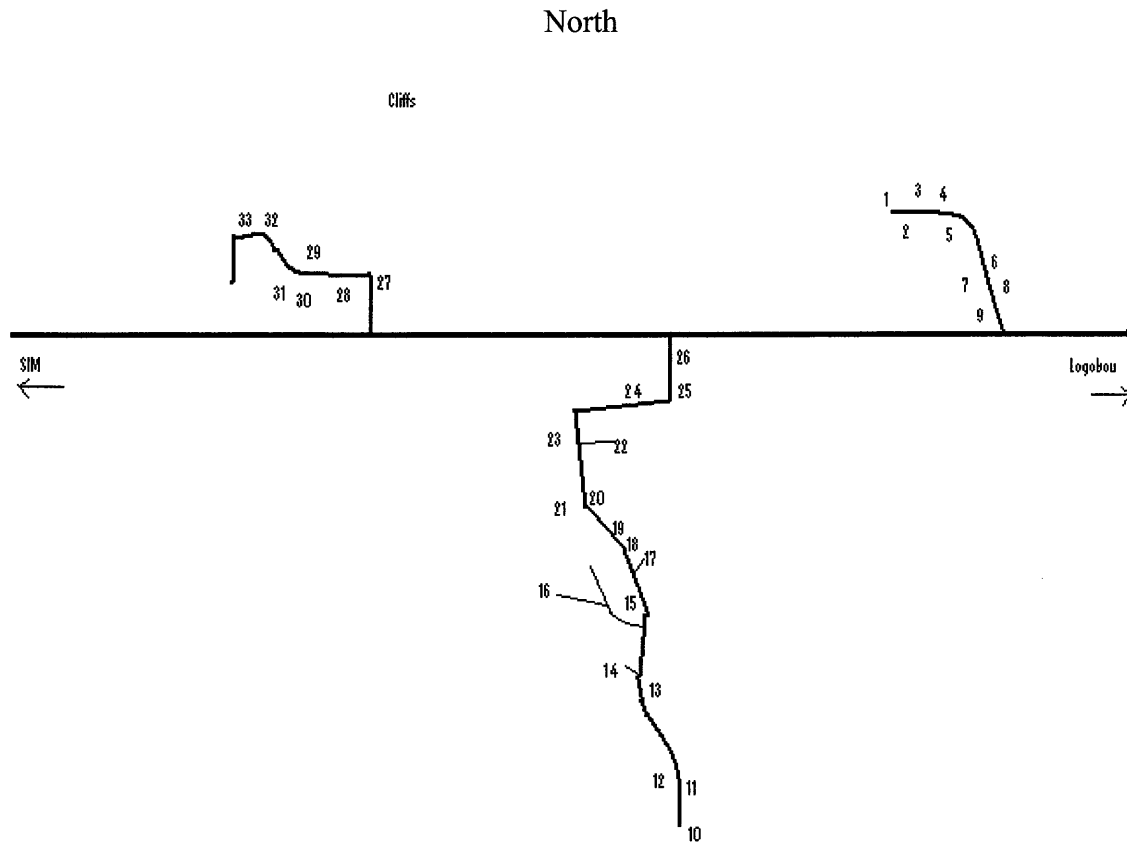
(Quand vous préparez vos cours et les enseignez, travaillez-vous souvent avec d'autres enseignants?)

14. Does your school have a library? If so, how do students use it?

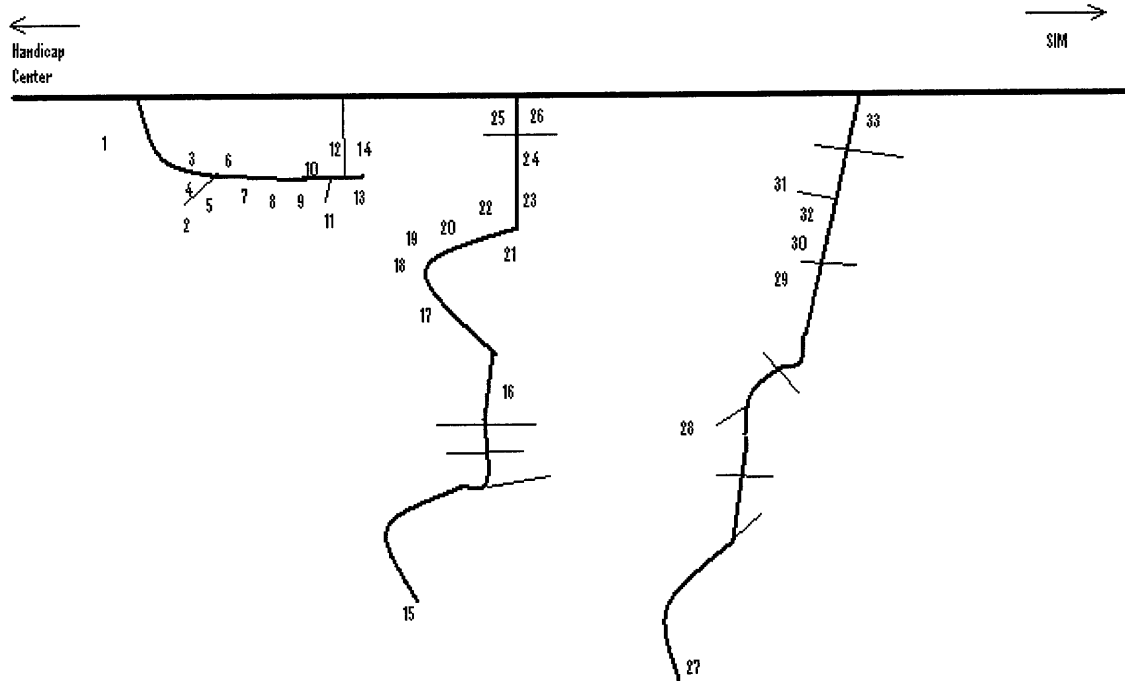
(Cette école où vous travaillez, est-ce qu'il y a une bibliothèque pour les étudiants? Si oui, comment les étudiants l'utilisent-ils?)

Appendix G

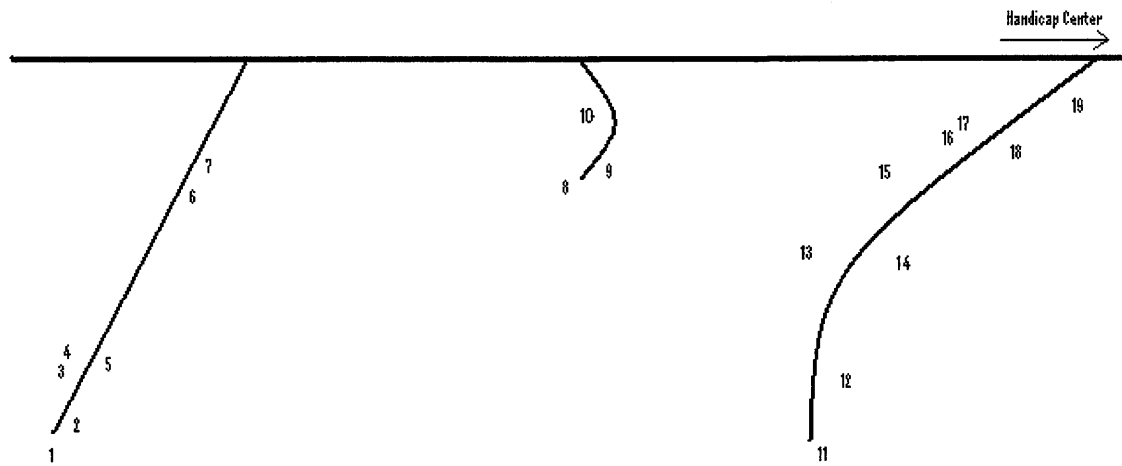
Maps of Regions of Mahadaga



Central



South



Appendix H

Household Survey Raw Data

(See attached spreadsheet)

Appendix I

Teacher Survey Raw Data

(See attached spreadsheet)

